US005499425A

United States Patent [19]

Glenn, III

[11] **Patent Number: 5,499,425**

[45] **Date of Patent: Mar. 19, 1996**

[54] **HEIGHT ADJUSTMENT MECHANISM FOR AN UPRIGHT VACUUM CLEANER**

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[73] Assignee: **Ryobi Motor Products**, Easley, S.C.

[21] Appl. No.: **360,252**

[22] Filed: **Dec. 20, 1994**

[51] **Int. Cl.**[6] **A47L 5/34**

[52] **U.S. Cl.** **15/354**; 15/339

[58] **Field of Search** 15/354, 355, 356, 15/368, 373, 339

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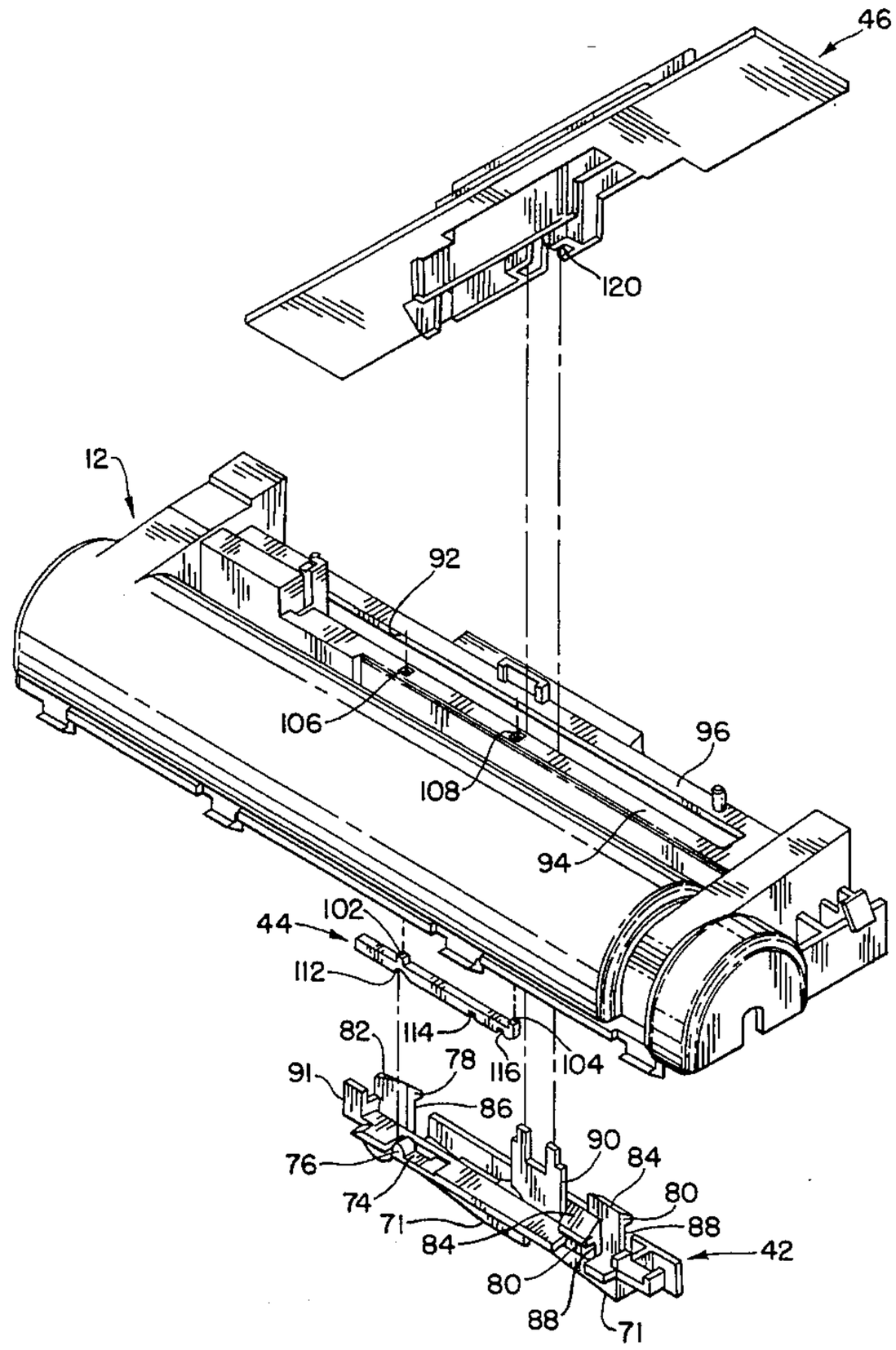
Primary Examiner—Chris K. Moore

Attorney, Agent, or Firm—Brooks & Kushman

[57] **ABSTRACT**

A vacuum cleaner and a method for constructing a vacuum cleaner is disclosed. The vacuum cleaner utilizes interchangeable detent bars having different numbers of detents thereon to selectively determine the number of height adjustment selections the vacuum cleaner will have. The vacuum cleaner includes a chassis, a detent bar attached to the chassis, a cam member slidably mounted to the chassis and a wheel retainer with laterally spaced wheels thereon. The wheel retainer is pivotally mounted to chassis such that the wheels may pivot toward and away from the chassis. The wheel retainer has a cam follower surface thereon which operatively cooperates with a cam surface on the cam member to raise and lower the wheels relative to the chassis as the cam member is moved. The cam member has a finger selectively engageable with individual detents on the detent bar to selectively laterally position the cam member relative to the chassis and thereby selectively establish the height of the chassis from a floor surface. The number of selectable height positions that the vacuum cleaner has is determined by the number of detents of the particular detent bar chosen to be installed on the chassis.

6 Claims, 4 Drawing Sheets



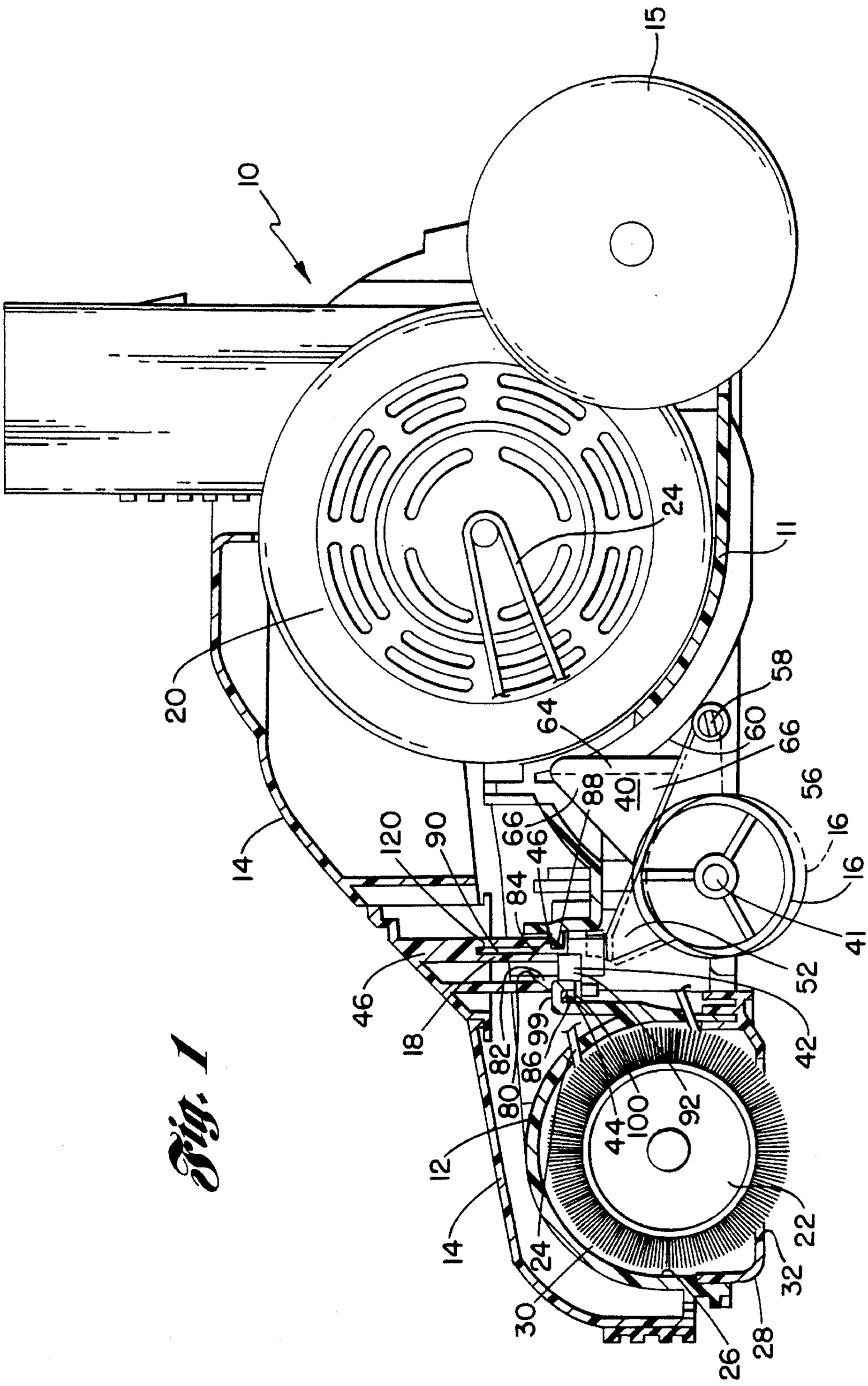

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Fig. 1

Fig. 2

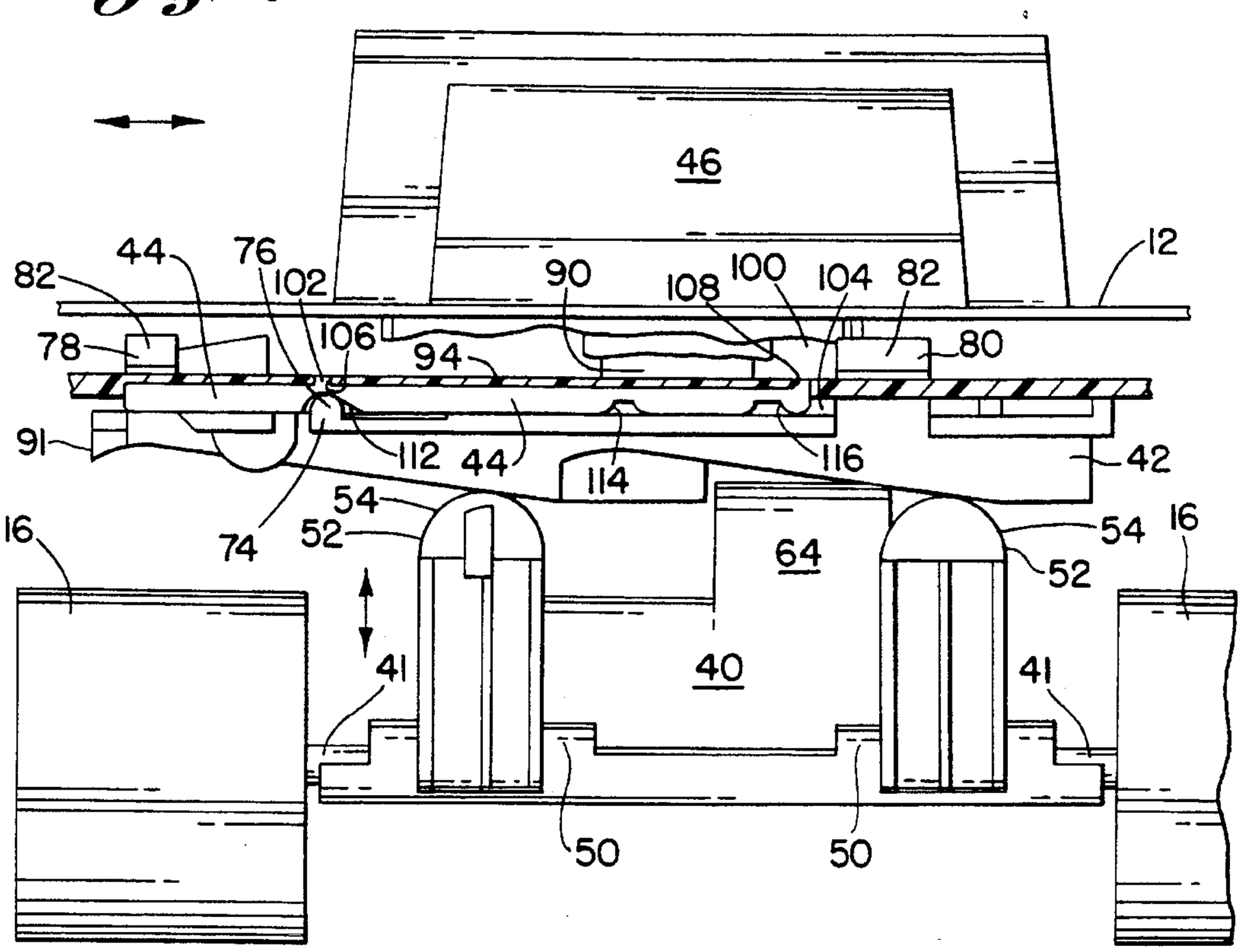
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Fig. 3

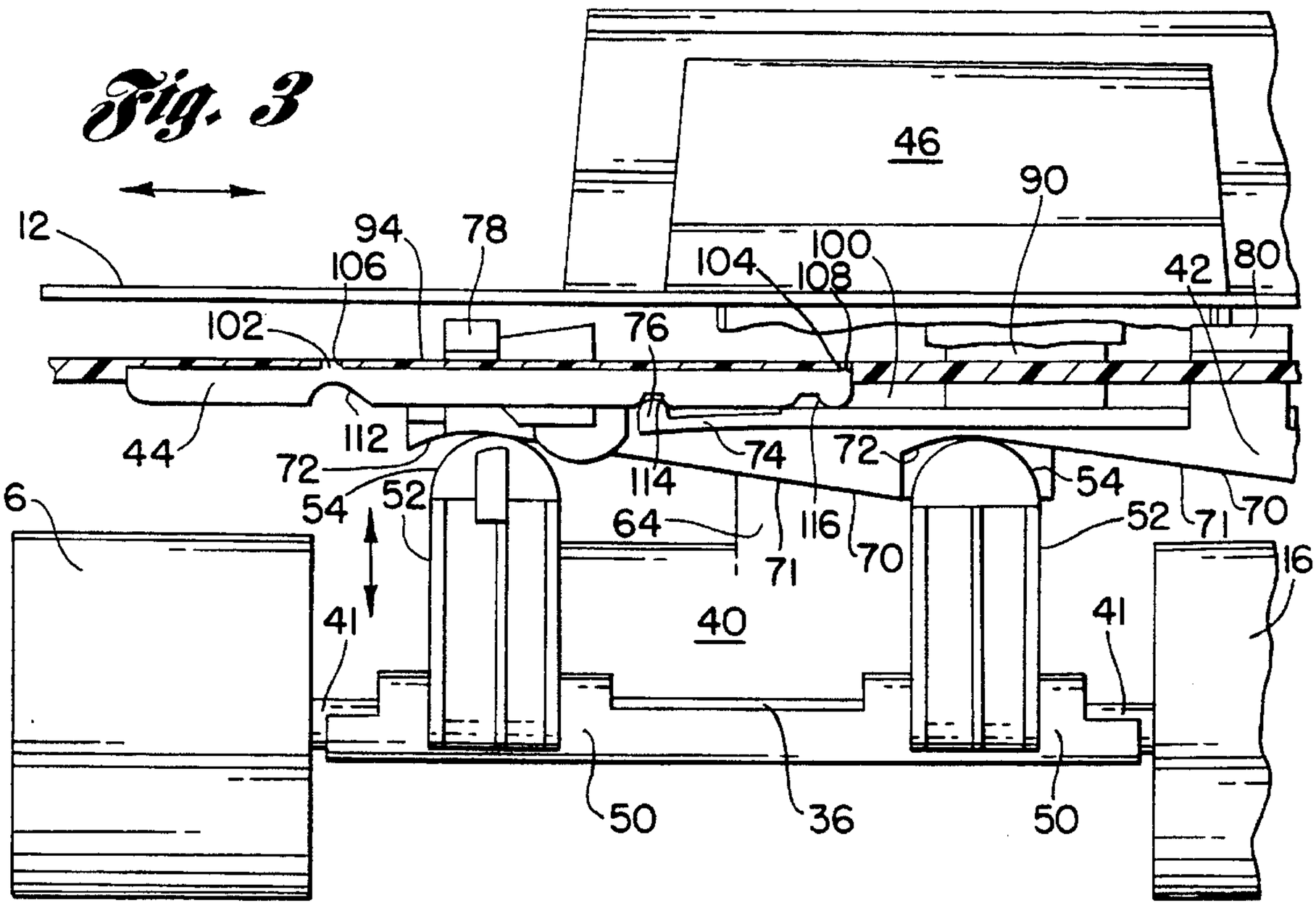
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Fig. 4

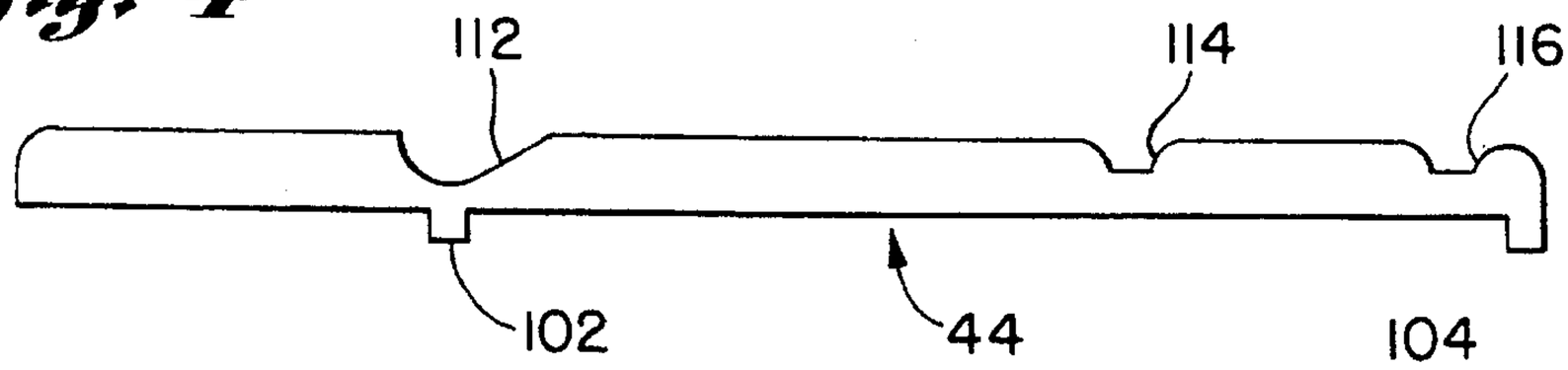


Fig. 5

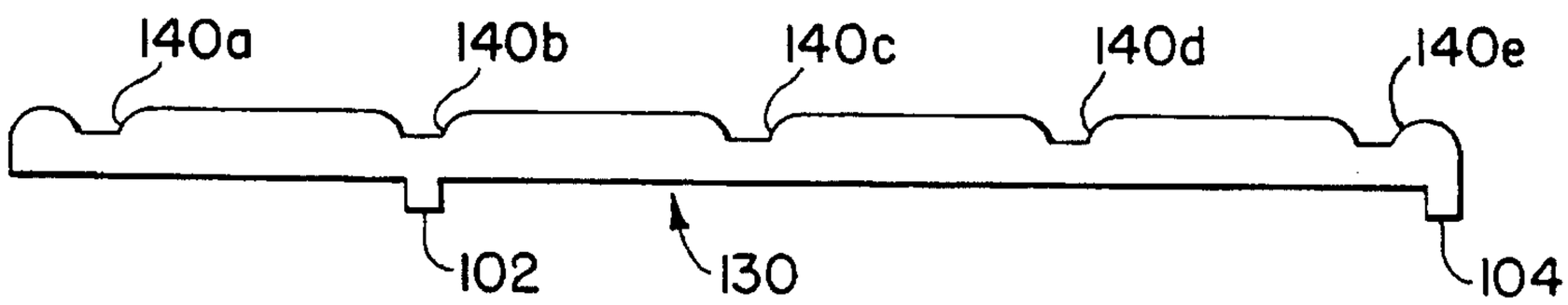


Fig. 6

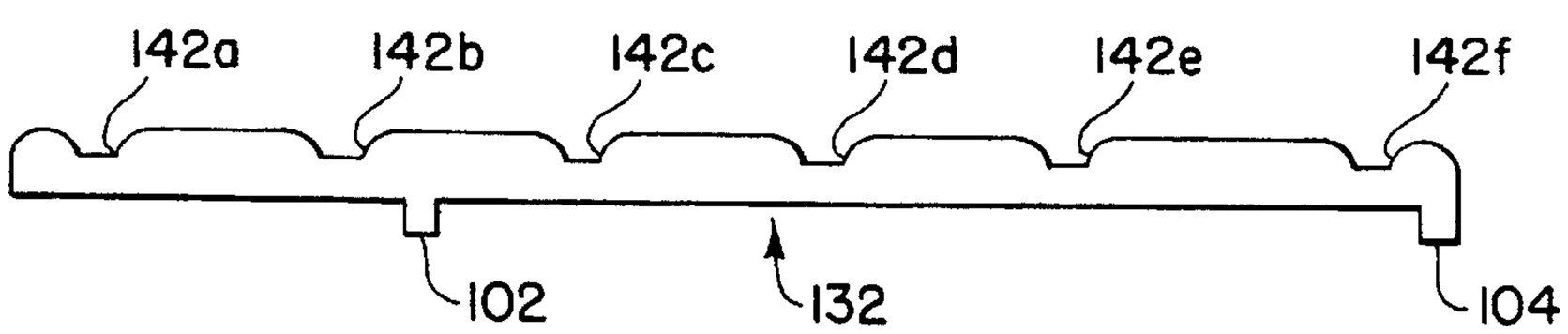


Fig. 7

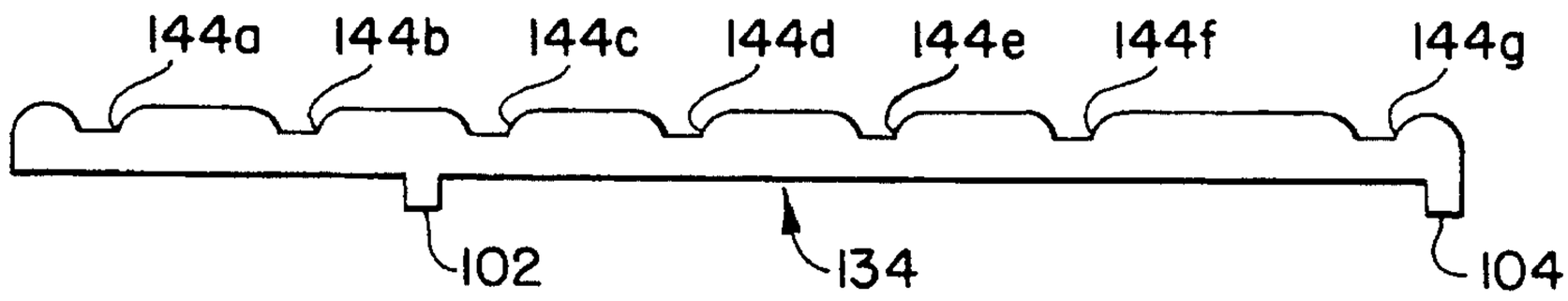
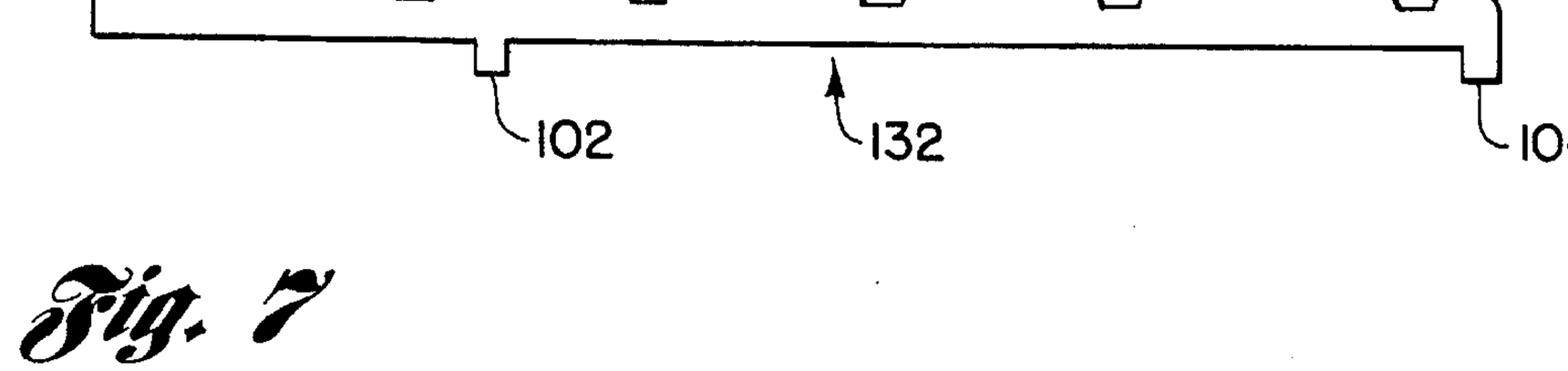


Fig. 8



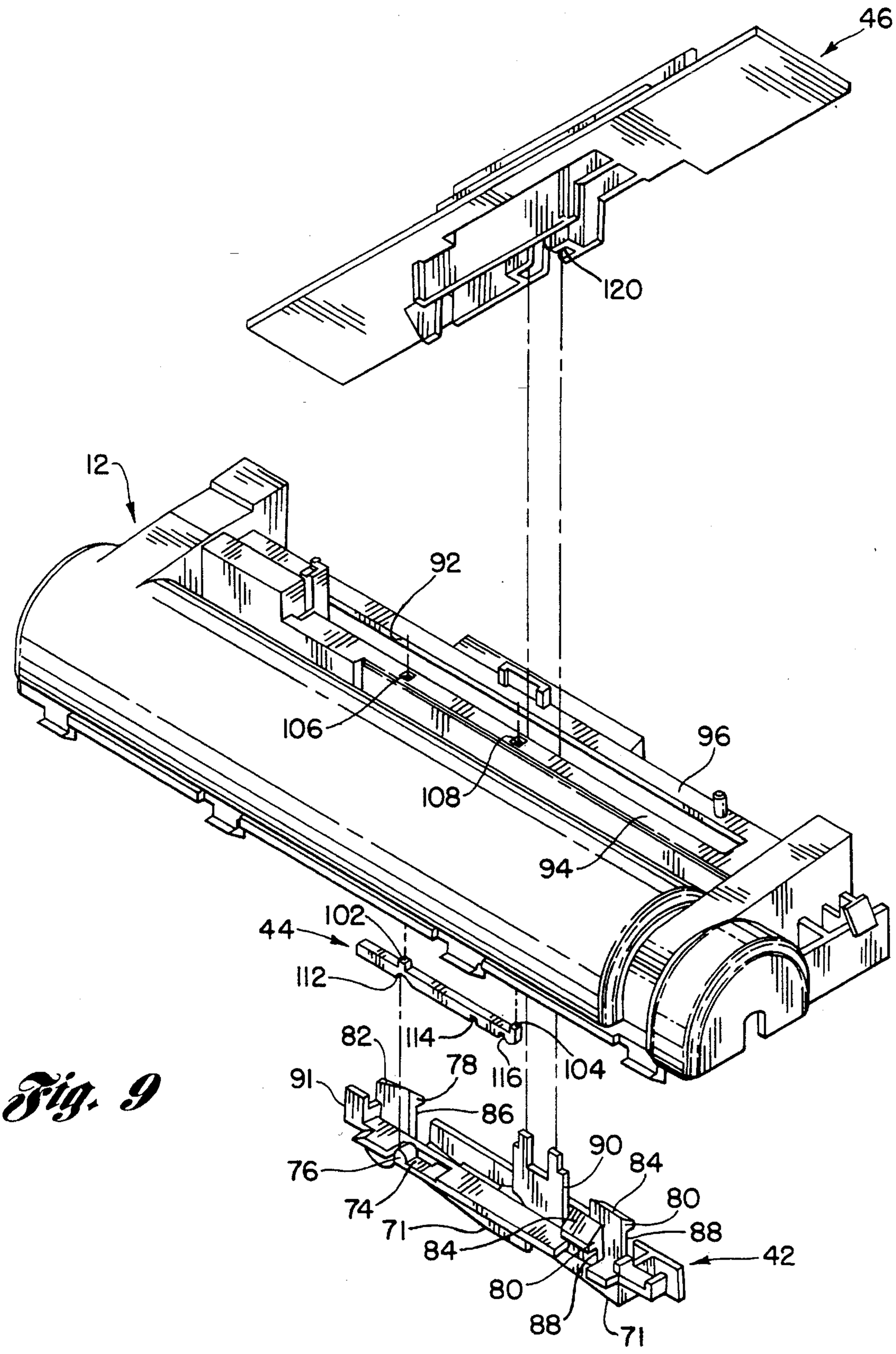

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Fig. 9

HEIGHT ADJUSTMENT MECHANISM FOR AN UPRIGHT VACUUM CLEANER

INCORPORATION BY REFERENCE

This application hereby incorporates by reference U.S. Pat. No. 5,222,276 to Glenn III, entitled Vacuum Cleaner For On Floor and Off Floor Suction Cleaning.

TECHNICAL FIELD

This invention relates to height adjustment mechanisms for floor nozzles or head assemblies of upright vacuum cleaners.

BACKGROUND OF THE INVENTION

Upright vacuum cleaners are generally provided with a height adjustment mechanism for varying the height of a chassis of a head assembly relative to a floor surface. The chassis carries a motor and fan and an agitator brush for brushing a floor surface to be cleaned. The distance the chassis and agitator brush are raised above a floor surface is dependent upon the type of floor surface to be cleaned. For example, if a linoleum or vinyl floor is being vacuumed, the agitator brush is spaced closely to the floor. In contrast, if a very deep pile carpet is being cleaned, the agitator brush is raised away from the floor surface to keep the agitator brush from binding with the individual strands of the carpet..

One popular technique of adjusting the relative height a chassis and agitator brush of a vacuum cleaner relative to a floor surface is to provide a movable variable height cam member intermediate the chassis and an axle or wheel retainer supporting front wheels. An example of a vacuum cleaner employing such a height adjustment mechanism is described U.S. Pat. No. 5,222,276, which has been incorporated herein by reference.

In that patent, a cam member has a pair of transversely spaced cam surfaces each having a series of varying height arcuate stepped cam surfaces. The stepped cam surfaces cooperate with a respective pair of cam followers formed on an axle retainer member supporting an axle and front wheels. The axle retainer member is pivotally attached to a chassis to rotate relative thereto about a transversely extending pivot axis. The pivoting of the axle retainer member and axle about the pivot axis will raise and lower the wheels relative to the chassis with the chassis, in turn, pivoting about a pair of back wheels. A knob is used to manually move the cam member from side to side. This causes different stepped cam surfaces to selectively engage the cam followers. Consequently, the axle retainer member pivots raising and lower the front wheels to one of a plurality of selected heights which is dependent upon the height of the individual stepped cam surfaces cooperating with the cam followers.

Inexpensive models of vacuum cleaners often provide only two or three different height adjustment settings of the chassis and agitator brush relative to a floor surface. More expensive or deluxe models, partially due to the need for product differentiation, generally provide for a greater number of height adjustment selections. Accordingly, different tooling and molds are required for the different height adjusting mechanisms of the different vacuum cleaners. This can result in significant tooling costs for creating a line of vacuum cleaners which have different numbers of height selection positions, particularly, if a series of complex molds

need to be made for each model in the line of vacuum cleaners.

The present invention is intended to meet the need for providing height adjustment mechanisms for vacuum cleaners which provide for a wide selection of the number of possible height adjustment settings for different models at a low cost.

SUMMARY OF THE INVENTION

A vacuum cleaner comprising a chassis, a discrete detent rack, a wheel retainer member and wheels, and a cam member is disclosed. The chassis supports a motor and a fan. The discrete detent rack is attached to the chassis and has a plurality of detents formed thereon. The wheel retainer member is pivotally attached to the chassis to pivot about a transversely extending pivot axis. The wheel retainer member supports a pair of laterally spaced apart wheels and has at least one cam follower surface thereon, and preferably two.

The cam member is movably mounted relative to the chassis and has a variable height cam surface thereon for operatively engaging the cam follower surface of the wheel retainer member. The cam member has a positioning finger thereon for engaging one of the plurality of detents to selectively laterally position the cam surface relative to the cam follower surface thereby adjusting the distance between the wheels and the chassis. A handle may be provided which attaches to the cam member for manually moving the cam member relative to the chassis thereby raising and lowering the wheels relative to the chassis.

This design allows detent bars with different numbers of detents thereon, or with differently spaced detents, to be interchangeably attached to a standard chassis to construct vacuum cleaners with different numbers of height adjustment settings or positions.

Preferably, the cam surface has a pair of laterally spaced linear ramp portions and the wheel retainer member has a pair of laterally spaced cam follower surfaces which respectively cooperate with the linear ramp portions.

The present invention also includes a method for making a vacuum cleaner wherein the vacuum cleaner can be constructed with different predetermined number of height adjustment settings. The method comprises the following steps. A chassis is provided. A motor and fan is attached to the chassis. A detent bar having a predetermined number of detents is selected from a plurality of detent bars having different numbers of detents thereon. The detent bar is attached to the chassis. A cam member is movably mounted to the chassis and has a cam surface of varying height thereon. The cam member also has a finger for selectively engaging one of the plurality of detents to selectively position the cam member relative to the wheel retainer member.

The wheel retainer member is pivotally attached to the chassis. The wheel retainer member has a cam follower surface thereon which cooperates with the cam surface of the cam member to adjust the distance between the wheels and the chassis dependent upon which of the detents the finger is selectively engaged.

This method allows the number of selectable height adjustment positions the vacuum cleaner possesses to be controlled by selecting an appropriate detent bar having a desired number of detents.

It is an object of the present invention to provide a height adjustment mechanism for a vacuum cleaner which utilizes

interchangeable detent bars having different predetermined numbers of detents thereon corresponding to the desired number of height adjustment selections.

It is another object to provide a vacuum cleaner which has a height adjustment mechanism which utilizes interchangeable detent bars to change the number of height adjustment positions that the vacuum cleaner may have.

An advantage the present invention has over other adjustable height vacuum cleaners is that standard molded parts made from costly, complex molds, such as a chassis, a cam member and a wheel retainer, can be used with interchangeable detent bars made from relative inexpensive molds to thereby provide vacuum cleaners with a wide range of selectable number of height adjustment positions at a low cost.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features, objects and advantages of the present invention will become readily apparent from the following description, pending claims, and accompanying sheet of drawings where:

FIG. **1** is a side sectional view of a head assembly of a vacuum cleaner utilizing an interchangeable detent bar made in accordance with the present invention;

FIG. **2** is a fragmentary front sectional view of the vacuum cleaner with wheels in an extended position;

FIG. **3** is view similar to FIG. **2** with the wheels in a retracted position;

FIGS. **4–8** show a plurality of interchangeable detent bars having different numbers of positioning detents located along the length of the bar; and

FIG. **9** is an exploded perspective view of a handle, a fragmentary portion of the chassis, a detent bar and a cam member.

BEST MODE FOR CARRYING OUT THE INVENTION

FIG. **1** shows an upright vacuum cleaner **10** with a head assembly **11** shown partially in cut-away. Vacuum cleaner **10** has a chassis **12** and an overlying hood **14** which releasably snaps thereon. Ideally both chassis **12** and hood **14** are made of injection molded plastic. Rear wheels **15** (one of which is shown) is mounted on the rear of chassis **12**. A pair of transversely or laterally spaced front wheels **16** are supported on chassis **12** by a height adjustment mechanism **18** as will be described later.

A motor/fan assembly **20** is mounted in a pair of journals formed in chassis **12**. An agitator brush **22** is supported on bearings within chassis **12**. A pulley belt **24** extends between motor/fan assembly **20** and agitator brush **22** to rotatably drive agitator brush **22**.

A laterally extending, generally semi-cylindrical cavity **26** is defined in the front portion of chassis **12**. A lower cover plate **28** cooperates with chassis **12** to form an agitator brush chamber **30** in which agitator brush **22** is disposed. A lower opening **32** provides access for the bristles of agitator brush **22** to extend out of brush chamber **30**. Although not shown, lower cover plate **28** cooperates with chassis **12** to form a longitudinally extending belt chamber and a longitudinally extending air passageway from brush chamber **30** to motor/fan assembly **20**.

As indicated in FIG. **1**, front wheels **16** are selectably positionable between a retracted position as shown in full line and an extended position shown in dashed line. In fact, front wheels **16** may be positioned at a number of selected heights relative to chassis **12** due to the operation of height adjustment mechanism **18**.

Turning now to FIGS. **2** and **3**, height adjustment mechanism **18** includes a laterally extending wheel retainer **40** including an axle **41**, a cam member **42**, a detent bar **44**, and a handle **46**. Ideally, wheel retainer **40**, cam member **42** and handle **46** are injection molded parts. FIG. **9** shows a perspective view of handle **46**, a portion of chassis **12**, detent bar **44** and cam member **42**. FIG. **2** shows front wheels **16** extended away from chassis **12**, thereby placing agitator brush **22** in a raised position relative to a floor surface. FIG. **3** shows wheels **16** retracted relative to chassis **12**, thereby placing agitator brush **22** in a lowered position relative to front wheels **16** and a floor surface. This retracted position is ideal for cleaning linoleum or very short pile carpeting. In the extended position of FIG. **2**, vacuum cleaner **10** ideally is used to clean deep pile carpet, such as shag carpet.

Wheel retainer **40** includes a pair of laterally spaced hub portions **50** through which axle **41** passes. Extending vertically upward from hub portions **50** are a pair of legs **52**, which terminate in cam follower surfaces **54**. Referring back to FIG. **1**, extending rearwardly from and intermediate hub portions **50** is a base plate **56** which has an integrally formed axle **58** at the rear end portion thereof. A pair of laterally spaced forks **60**, one of which is shown on chassis **12**, rotatably support axle **58** to pivot about a pivot axis extending coaxial with axle **58**. Wheel retainer **40**, which supports axle **41** and front wheels **16**, therefore moves in an arcuate path about the pivot axis. While preferably axle **41** is a separate metal axle supported by wheel retainer **40**, it is also possible that such an axle could be integrally formed on wheel retainer **40**, similar to axle **58**. A vertical wall **64** extends vertically upward from base plate **56** and is supported by a web **66**.

Returning to FIG. **3**, cam member **42** has a pair of laterally spaced cam surfaces **70** formed on its lower side which include linear ramp portions **71** terminating in arcuate portions **72**. Cam follower surfaces **54** on legs **52** of wheel retainer **40** abuttingly engage cam surfaces **70**. As cam follower surfaces **54** slide up and down cam surfaces **70**, wheel retainer **40** pivot about axle **58** and wheels **16** retract and extend relative to chassis **12**.

As best seen in FIG. **9**, integrally formed on the top of cam member **42** is a cantilevered finger **74** with a retaining tab **76** formed at an end thereof. Laterally spaced mounting clips **78** and **80** are formed on cam member **42** and extend upwardly. Clips **78** and **80** are used to slidingly mount cam member **42** to chassis **12**. Clip **78** has a single prong **82** and clip **80** has a pair of opposing prongs **84** with respective outboard extending L-shaped mounting surfaces **86** and **88** located on the underside of the prongs. Located between clips **78** and **80** is an upwardly extending lug member **90**.

Cam member **42** has a distal end **91** which can be used to abut and close a spring biased open conversion door (not shown) to shut off air flow through the passageway extending from brush chamber **30** to the motor/fan assembly **20**. Such doors are well known to effect conversion of an upright vacuum cleaner between on floor and off floor cleaning modes. As this invention is directed to a particular height adjustment mechanism for a vacuum cleaner, further details regarding the operation of the conversion door will not be described.

Referring again to FIG. **1**, chassis **12** has an elongate slot **92** which extends laterally and in which cam member **42** slidably mounts. Horizontal bearing surfaces **94** and **96** are

adjacent slot **92**. The L-shaped mounting surfaces **86** and **88** of clips **78** and **80** are mounted and slide upon mounting surfaces **94** and **96**. Prongs **82** and **84** are resilient and may be squeezed together to allow their insertion through slot **92** and then released with mounting surfaces **86** and **88** residing upon bearing surfaces **94** and **96** of chassis **12**.

An inverted channel **100** is formed in chassis **12** forwardly of and extends parallel with elongate slot **92**. Detent bar **44** is held within this channel **100**.

Detent bar **44** is an elongate member with upwardly extending retaining bosses **102** and **104**, as seen in FIGS. **1–2** and **10**. Retaining bosses **102** and **104** are pressed into openings **106** and **108** formed beneath mounting surface **94** of chassis **12**. Formed on the underside of detent bar **44** are a plurality of spaced apart detent **112**, **114** and **116**. Detents **112**, **114** and **116** are sized to receive retaining tab **76** of cam member **42** thereby positioning and holding cam member **42** relative to chassis **12** at selected lateral positions. This results in cam follower surfaces **54** engaging cam surfaces **70** at particular lateral positions and locating wheel retainer **40** and wheels **16** at selected distances or heights from chassis **12**.

Handle **46** has a pocket **120** formed on the underside thereof sized to receive lug member **90** of cam member **42**. Accordingly, the laterally translation of handle **46** relative to chassis **12** will move cam member **42** laterally as well. This lateral movement will cause wheel retainer **40** to rise and fall relative to chassis **12** as cam follower surfaces **54** engage the varying height linear ramps portions **71** of cam surfaces **70**. Handle **46** is aesthetically designed to blend in with the contours of hood **14** covering chassis **12**.

FIGS. **5–8** show different embodiments of detent bars **44**, **130**, **132**, **134** and **136**. Detent bars **44**, **130**, **132**, **134** and **136** are generally identical with the exception of the number of detents located therein. Accordingly, identical structure such as retaining bosses **102** and **104** are identically identified in the detent bars of FIGS. **4–8**. Detent bars **130**, **132**, **134** and **136**, respectively, have detents **140***a–e*, **142***a–f*, **144***a–g*, and **146***a–k*.

When a vacuum cleaner, such as vacuum cleaner **10**, is being assembled, a determination is made as to the number of height adjustment selections needed. The greater the number of detents on a detent bar the greater the number of height adjustment selections available. This increases the height adjustment sensitivity of the vacuum cleaner. An appropriate detent bar is chosen and retaining bosses **102** and **104** are installed in openings **106** and **108** of chassis **12**.

Next, prongs **82** and **84** of cam member **42** are squeezed together and inserted into elongate slot **92** of chassis **12**. Mounting surfaces **86** and **88** of prongs **82** and **84** slidably bear upon bearing surfaces **94** and **96** of chassis **12** allowing for relative lateral movement between cam member **42** and chassis **12**. Concurrently, lug member **90** is also passed through slot **92**. Handle **46** is placed over cam member **42** with lug member **90** being received within pocket **120**.

Wheel retainer **40** with axle **41** and wheels **16** is then attached to chassis **12**. Axle **58** is snapped into sockets **62** thereby pivotally attaching wheel retainer **40** to chassis **12**.

The present invention using interchangeable detent bars, mountable within a single chassis, therefore affords great design flexibility at a low cost as the molds for the detent bar are generally quite inexpensive. Only single molds for each of chassis **12**, cam member **42**, and wheel retainer **40** are needed.

While the foregoing specification of this invention has been described in relation to a certain preferred embodiment thereof, and many details have been set forth for purposes of illustration, it will be apparent to those skilled in the art that the invention is susceptible to additional embodiments and that certain of the details described herein can be varied considerably without departing from the basic principles of the invention.

What is claimed is:

1. A vacuum cleaner comprising:

a chassis supporting a motor and a fan;

an interchangeable detent bar attached to the chassis having a plurality of detents;

a wheel retainer pivotally attached to the chassis to pivot about a laterally extending pivot axis, the wheel retainer supporting a pair of laterally spaced apart wheels and having at least one upwardly extending strut with a cam follower surface thereon;

a cam member movably mounted to the chassis and having a variable height cam surface thereon for engaging the cam follower surface of the wheel retainer, the cam member having a positioning finger thereon for selectively engaging the plurality of detents to selectively laterally position the cam surface relative to the cam follower surface thereby adjusting the distance between the wheels and the chassis; and

a handle attached to the cam member for moving the cam member relative to the chassis thereby raising and lowering the wheels relative to the chassis;

wherein the interchangeable detent bar may be replaced with another detent bar having a different number of detents thereon so that the number of height adjustment settings may be altered.

2. The vacuum cleaner of claim **1** wherein:

the cam surface includes a linear ramp portion.

3. The vacuum cleaner of claim **1** wherein:

the cam surface includes two laterally spaced apart linear ramp portions and the wheel retainer includes a pair of laterally spaced apart cam follower surfaces which cooperate the respective linear surfaces to adjust the distance between the wheels and the chassis.

4. The vacuum cleaner of claim **1** wherein:

the cam member includes a main body and the finger is cantilevered from the main body.

5. The vacuum cleaner of claim **1** wherein:

the handle is integrally formed with the cam member.

6. A method for making a vacuum cleaner comprising:

providing a chassis;

attaching a motor and fan to the chassis;

selecting a detent bar having a predetermined number of detents thereon from a plurality of detent bars having different predetermined numbers of detents;

attaching the selected detent bar to the chassis;

movably mounting a cam member to the chassis, the cam member having a cam surface of varying height thereon and a finger for selectively engaging the predetermined number of detent; and

pivotally attaching a wheel retainer and wheels to the chassis, the wheel retainer having a cam follower surface thereon which cooperates with the cam surface to adjust the distance between the wheels and the chassis dependent upon which one of the detents the finger engages;

whereby the number of height adjustment positions the vacuum cleaner possesses is controlled by which one of the plurality of detent bars is selected to be attached to the chassis.

* * * * *